# The Planters' Chronicle.

RECOGNISED AS THE OFFICIAL ORGAN OF THE U. P. A. S. I., INCORPORATED.

VOL. VIII. No. 26.] JUNE 28, 1913. [PRICE AS. 8.

## THE U. P. A. S. I.

(INCORPORATED.)

### Contents.

The Scientific Department publishes useful information on three important points namely Tea Seed Oil. Sophora glauca, and Camphor.

A very simple remark by the Editor in last week's issue, has had the effect of extracting a letter from Mr. Dauvers, on the subject of Green Bug, which is answered, as requested, by the Planting Expert, which we hope, will convince Mr. Dauvers, which is thought to be the best method. While this Green Bug is threatening, it will be advisable to reprint Mr. Brown's articles on the subject, which with his permission we hope to do in our next.

An article has been contributed on the coming U. P. A. S. I. Exhibition, urging the utility of such a show, and asking for the co-operation of all concerned in the various industries. We feel confident, that a varied selection of products will be the response to our appeal; which will interest all sorts of visitors. The Secretary has been frequently asked by the consumers of the products of our industries, what he can show them. The ignorance of these same consumers, is astonishing. But what we believe will add chiefly to the attractiveness of the Exhibition, would be labour saving appliances, and to this end we trust all will help. A series of photographs also, would be much appreciated.

A very interesting article on the preparation of Hevea Rubber is republished from the F. M. S. Department of Agriculture, who issued a Bulletin on the subject. The experiments with solutions will be found valuable, and the remarks on the cause of tackiness in rubber, should be noted. Further experiment will decide, whether this tackiness is due to heat rays or light rays.

The Report of the Superintendent of the Rubber Sub-Station in Hawaii, deals with tapping from the commercial point of view, which shows a good profit considering the cost of labour. Comparing the cost of Hawaiian labour and Indian labour, useful deductions can be drawn.

## THE SCIENTIFIC DEPARTMENT, U.P.A.S.I.

*Tea Seed Oil.—The Bulletin of the Imperial Institute* and other Scientific papers have had a good deal to say recently about Tea Seed Oil, and in *Tropical Life* for May, an article appears on the subject from which I gather, that this oil is especially useful for soap-making, and though not obtainable in large quantities, would command a fair price. Assam Tea Seed, is said to contain 43·45% of oil. The residual cake contains only 1·92% of nitrogen and so is not of much value as a manure. It is possible that something might be done with this oil in conjunction with Hevea Seed Oil. In February 1912, the oil was priced at £21 per ton in Hull, and at the present time, since the price of Cotton Seed Oil has risen, it is probably worth more than this, and it would find a market in England for lubricating and soap-making purposes.

*Sophora glauca.*—By the courtesy of the Director of Agriculture, I have been favoured with the following analysis of *Sophora glauca* made by the Government Chemist at Coimbatore.

| | Samples as received. | Calculated on dry matter. | Ash. |
|---|---|---|---|
| Moisture ... | 65·00 | — | — |
| Organic Matter ... | 33·06 | 94·45 | — |
| Soluble Mineral Matter ... | 1·88 | 5·38 | 96·93 |
| Insoluble Mineral Matter ... | 0·06 | 0·17 | 3·07 |
| | 100·00 | 100·00 | 100·00 |
| Containing Nitrogen ... | 0·90 | 2·57 | — |
| Containing Phosphoric Acid ... | 0·19 | 0·54 | 9·73 |
| „ Potash ... | 0·47 | 1·35 | 24·14 |

It will be noted that the plant contains a high percentage of Potash as well as Nitrogen, and Mr. Harrison recommends its use as a green manure for Tea and Coffee. *Sophora glauca*, is a very common plant on the Hills in the Nilgiris, Shevaroys, Coorg and Mysore. It is a small shrub with soft pinnate leaves, a drooping spike of pretty pinkish-red flowers. In Coorg it has been used as a green dressing in Coffee to some extent but, as it is shrubby, it is apt to be troublesome to eradicate. When it can be cut in the jungle, however, and carried into the Coffee it is evidently of great value. In Tea it might be grown with advantage, as it would give a light shade especially in young clearings.

*Camphor.*—The Superintendent of the Experimental Plantations of the Malay States, recommends beginning to cut Camphor plants in their third year. An acre containing 700 three year old Camphor trees is said to give annually in three cuttings 180 lbs. of Camphor. Distillation experiments show that a yield of about one per cent of camphor and of oil consisting chiefly of camphor, can be obtained from the leaves and branches of trees of five years of age and perhaps younger. The time of distillation ought not to exceed three hours in the case of the leaves and young branches. The propottion of camphor obtained from the leaves is greater than that yielded by the branches, and the yield of the small shoots is more than that of the older branches of trees of the same age. Drying in the open air has no bad effect upon the yield, but this would probably not be the case if the leaves were exposed to the direct rays of the tropical sun.—R.D.A.

## CORRESPONDENCE.

Balur P. O.,
Kadur District,
Mysore State;
Kelagur Estate, June 19th, 1912.

### The "Green Bug."

THE EDITOR,
*Planters' Chronicle.*

Sir,—In the notes of "Contents" in your issue of the 14th instant, it is remarked that it is hoped that the N. Mysore Planters have "also ordered Sprayers for the insecticides, as without them the latter will not be of much use. It will be like Hamlet with the part of Hamlet left out."

We have no intention of leaving out the part of Hamlet, but it has been left to the discretion of the individual, should the play unfortunately be produced on his particular stage, to decide whether the official choice of Mr. Sprayer should be adhered to, or whether the part should be enacted by Mr. Brush, a far finer actor in the opinion of some play-goers.

As the Scientific Officer has lately been among the Brushites, it would be of great interest if he would give us his opinion as to the respective merits of Sprayer and Brush.

Yours faithfully,
(Signed) C, DANVERS.

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Dear Sir,—Brushing *versus* Spraying for Lecanium scale is an old controversy in the Nilgiris and elsewhere, and there is much to be said on both sides. The case for brushing is, that it is very thorough since the trees can be gone over leaf by leaf and none can escape a coating of the wash; it is possible that the process kills the eggs as well as the scales; the coolies like the work better than they do spraying, it being a game after their own hearts which is easy and "finniking."

The case for spraying is, that though difficult, it is rapid, and a large area can be covered in a short time, and by doing a second round, the scale missed the first time is secured.

The great objection to brushing is that it is slow and requiries a large labour force. The average task appears to be five trees per cooly, per day, and if a large area is infected, the pest is likely to get out of hand and spread over still larger areas, before the brushing gang can get round.

The objection to spraying is, that it is difficult, and it is work the cooly is unfitted for, especially with a Knapsack sprayer which has to be pumped. Probably easier work can be done with a Pressure sprayer.

These are the *pros* and *cons*. The cost is if anything in favour of the spraying method, the labour bill being very high in the case of brushing.

Both are practical methods, and I personally incline to favour spraying because it is rapid. Mr. Thomas Brown of the Nilgiris, is a great champion of spraying methods and planters should read what he has written about the success of the method in his hands before making up their minds to condemn spraying, especially without a trial.

If only an acre or two of coffee is infected, and a big gang of coolies is available, perhaps brushing may be the best treatment, but when a big area is infected, and the pest is rapidly increasing I think that spraying is undoubtedly the best way of dealing with the situation despite its obvious practical difficulties.

RUDOLPH. D. ANSTEAD, *Planting Expert.*

## U. P. A. S. I. EXHIBITION.

The following circular was sent to all Councillors of the United Planters' Association, but to give it wider publicity it has been thought advisable to reproduce it in the *Chronicle*, so as to invite suggestions how best to make the proposed Exhibition a success, from a wider circle:—

"Referring to my Circular No.9/13 dated June 4th, it was suggested that August 25th would be a convenient date on which to open the Annual Meeting, if suitable to District Associations. It is too early yet to have received replies for the Chairman to definitely fix the date. In the meanwhile, I think it would be advisable to remind Honorary Secretaries, that it is proposed to hold, as usual, an Exhibition of the various products of the different Districts, and I address you, and ask you to lend your co-operation in making the Exhibition thoroughly representative of all that is grown by the members of your Association, and to invite members to send samples. It is hoped with your cordial assistance not only to make the coming Exhibition thoroughly representative, but a permanent record of the progress of our industries from year to year. Such a permanent record would in itself be an education. The office contains nothing to show members who visit it, not only the best of their own Districts, but nothing to awaken a lively interest in the products of others. I hope to hear from you that you will do all you can to induce your members to further this very useful suggestion. Due notice will be given you when the Chairman has been able to fix the actual date of meeting, to enable you to forward exhibits some time before the meeting takes place."

Since writing the above the Chairman has definitely fixed the 25th August for the Annual Meeting, so those who have arranged to send samples for the Exhibition are requested to forward them to the office by the 18th instant to enable us to arrange them for the show.

The idea of holding an Exhibition at the coming Annual Meeting is not original, only the idea of having permanent exhibits at the office is an improvement on it. Primarily the Exhibition was intended to show Delegates attending the Annual Meeting the products of the various Districts, and in 1911, Messrs. Peirce Leslie and Co., and others showed Estate tools, tapping knives, glass collecting cups, etc., and again in 1912 new Coffee Machinery was set up and exhibited. These Exhibitions have proved of great interest and have been voted a success, but the interest aroused in them has been only temporary and evanescent.

Our idea is to have a permanent record in the office that planters, visiting Bangalore, may inspect and carry away with them a lasting impression of our varied industries. Year by year as our knowledge increases, and wider and more scientific methods are adopted in the curing and preparing for the market the various products, it would be both useful and interesting to watch the progressing merits of different properties. Just as errors are but opinion in the forming, seldom is it that one arrives at perfection at a bound. The wiseman is he who will benefit by the mistakes of others, and in the following year show the result of such observation for the benefit of those showing along the same lines, and become a benefactor to the planting community. It is by benefiting by the mistakes of one year that progress will be made and it is by collecting these attempts towards perfection we hope to attain it. Such a permanent record will be of the highest value as an object lesson.

We believe that such an Exhibition will be the means of bringing about correspondence between members of different districts, and bringing mem-

bers into close touch with one another. Such correspondence would probably have far wider reaching results than may be thought of at present.

One correspondent writes us:—"While always interested in seeing anything NEW as regards Planting, I cannot say that after making the journey to Bangalore, *chunks of ordinary rubber, more or less well cured*, parcels of coffee, tea, pepper or cardamoms would excite me," but we would respectfully point out to our correspondent, that it is our object to cater for the whole planting community and not for one member thereof. But we are sure, that on reflection, he will recognise that his views are rather narrow minded, and that what may not probably excite him, will be of interest to others, and *vice versa*. Our endeavour is to secure not only his interest and influence, but that of others to procure NEW exhibits, and with this object in our mind, we earnestly ask for the cordial co-operation of all in achieving the goal we aim at.

Though we do not agree with the opinion expressed above by our correspondent, it would be unfair to him to omit to say, that most useful suggestions have come from him, and we quote with pleasurable agreement from him "But what I should be interested in are new appliances connected with the industry. The latest thing in tapping chisels and knives, the last word in spouts, a cheap reliable and handy bucket for latex which could be issued to every coolie and that would keep the monsoon out side the pail, a measuring tape for taking girths that didn't expand daily until it was useless in three weeks. Glass, earthern ware and aluminium cups, &c." We welcome these suggestions, and will try to carry them out, but we should also welcome suggestions from tea and coffee planters.

If only half a dozen planters would evince the same interest as our correspondent in our coming Exhibition, it would be a pronounced success. What is wanted is more men to interest themselves, in the matter and to get others to do the same.

Though not quite germane to the matter, whenever some subject affecting planting comes under discussion, the Labour Question crops up with the fatal persistence of Charles' Head in Mr. Dick's Memorial and makes its ever unwelcome appearance. But as Labour is becoming more and more difficult to secure, labour saving appliances should be, if possible, procured for the Exhibition. These we are convinced, would be much appreciated, and for these we should look to those Firms who are interested in planting industries, and who should be asked to assist, and in this way everyone can help.

At present, the office only contains one show case of Rubber, for which we are indebted to the kindness of Messrs. Allan & Co. There is a complete series of Hevea Rubber, smoked and unsmoked. Samples of Fine Hard Pará from Brazil, castilloa and ceara.

The Mysore Dassara Exhibition is advertised to take place in October next, and samples shown and kept at our Exhibition could be sent, with the permission of the owners, to the Mysore Exhibition, thus saving planters the trouble of two collections. We have been asked what amount should be sent to form a sample. We consider that 2 lbs. each of tea, coffee, and cardamoms, and pepper would make a nice sample. About the same of each variety of Rubber

F. N.

## RUBBER.

### The Preparation of Plantation Hevea Rubber

*The India Rubber Journal* publishes lengthy extracts from *Bulletin No. 17 of the F. M. S. Department of Agriculture*, by Mr. B. J. Eaton, containing an account of a number of experiments which have been made on the best method of preparing Hevea rubber on the estate. The following is a digest of these articles.

The author points out that until comparatively recently, no systematic research has been carried out on practical lines in connection with this subject, and the good results which have been obtained on some estates, are not the outcome of scientific experiments, but the fortunate result of standard or uniform methods adopted by careful managers. Isolated experiments described in various journals cannot be relied upon, as it is quite probable that more than one variable factor has entered into many of these experiments where the latex has not been collected by the experimenter himself or under his supervision. The dilution of the latex with unknown amounts of water is one of these important factors.

In the experiments described by the author, the latex was collected in glass or porcelain cups without the addition of water and collected 3 or 4 hours after the trees were tapped and strained through fine brass sieves to remove dust, and naturally coagulated rubber. The trees from which the latex was obtained were about 12 years old, and had not been tapped previously. The method of tapping was 'light,' only four cuts, eighteen inches apart on one quarter section of the tree being made.

The first experiments made were with a large number of different coagulents in different quantities, and a table is given showing the minimum quantities of the principal acids and salts required to effect complete coagulation of a normal latex, containing about 30% of dry rubber. These quantities or a slight excess are also sufficient to coagulate the same quantity of a latex when mixed with an equal quantity of water. The results are at variance with those obtained by Parkin and Crossley, and the author concludes that for the acids experimented with, there is no constant 'maximum figure' above which coagulation is incomplete. The results are, in fact, anomalous in each case, for while certain intermediate quantities of coagulant appear to be a maximum, when a still larger quantity of coagulant is added, coagulation again takes place, and again, when a certain maximum figure is obtained, for a coagulant of one particular strength, this figure is different for an acid of another strength.

If a large excess of a dilute solution of a coagulant be added to latex the dilution of the latex is so great, that no coagulation occurs, since in the case of dilute solutions of coagulants or diluted a latex coagulation depends on a time factor and is not immediate. The failure to coagulate thus depends on the dilution and not the excess of acid. This is confirmed by the fact that a similar or larger quantities of the same acid or other coagulant produces complete coagulation when stronger solutions are used, because coagulation in this case is almost immediate.

The anomalous results produced by strong solutions of coagulants may also be explained on similar grounds. The rubber coagulum or clot, which is formed, occludes or absorbs the strong coagulant, and since local clotting or coagulation occurs immediately when a strong solution of coagulant is added, a portion of the latex is not acted upon by the coagulant. The partial coagulation of this remaining serum will no longer occur even when

more coagulant is subsequently added, and the failure to coagulate is thus, in one respect due to the method, being really due to the impossibility of obtaining a proper admixture of coagulant and latex, before coagulation occurs.

The above explanation appears to be the most satisfactory one for these apparently contradictory results, and there is no need to assume, as Crossley has done, a 'maximum figure' for any coagulant.

The experiments and results also show the wide limits in the quantities of coagulant which may be used, and the variation of this limit with the dilution of the latex and the concentration of the coagulant.

They also demonstrate the effect of excessive quantities of these acid coagulants on the rubber produced; excessive quantities have a deleterious effect and produce peculiar forms of coagulation.

With regard to the best coagulant, it is concluded that the acids, organic and mineral, undoubtedly, take first place as coagulating agents, and considered only from that standpoint, there appears to be little or no difference between acetic acid, which is at present used on almost all estates in Malaya, and other organic or mineral acids. The quality of the raw rubber *also appears to be independent of the acid used, any defect being due* to the quantity of acid used, and not to the nature of the acid, although excessive quantities of mineral acids have a much greater deteriorating effect on the rubber produced, than an excess of acetic acid.

The ultimate choice of the most suitable coagulant will depend on the following consideration, (*a*) the keeping properties of the rubber, (*b*) the strength of the vulcanized rubber, (c) the danger attached to the use of the coagulant, (*d*) the cost.

At the present stage, acetic acid is to be recommended as the most suitable coagulant to be used, although it is possible that this may be replaced later by sulphuric acid, which appears to give equally good results and is more economical. In this preparation of pale crepe by the addition of small quantities of sodium bisulphite, the cost is only slightly increased.

Experiments carried out with different strengths of coagulant, indicate that dilute solutions are preferable, as it is possible to obtain better admixtures of coagulant and latex with them and no local clotting occurs. A 5% solution of Acetic Acid is a very suitable strength, and a quantity of 3 fluid ounces per gallon of pure latex or 1½ fluid ounces per gallon of diluted latex containing about 15% of dry rubber is sufficient.

Experiments to ascertain the effect of dilution of the latex with water proved that if an average latex (containing about 30 per cent. of dry rubber) is diluted with water beyond a certain limit, no coagulation occurs with the minimum amounts of coagulant given on a previous page, This maximum limit is usually about two volumes of water to one volume of pure latex.

Beyond this dilution limit, not only must a larger quantity of coagulant be used, but, it must be of greater concentration, since the addition of large quantities of a dilute coagulant only causes further dilution of the latex. For example, it has been found that, in the case of a one per cent. acetic acid solution, 10 volumes of this acid per 100 volumes of pure latex, effects complete coagulation.

This same quantity also approximately effects the coagulation of 300 volumes of a latex containing about 10 per cent. of dry rubber, (*i. e.*, pure

latex diluted with two volumes of water). Beyond this point, however, no quantity of a one per cent. solution of acetic acid, however large, is able to coagulate a more diluted latex and an acid of greater concentration must be used. These results are not in accord with Parkin's experiments carried out in Ceylon, since Parkin states:—that dilution has no effect on the amount of coagulant required. Parkin's results are, however, at variance with other experimental work on the coagulation of colloids in general.

Apart, however, from the effect of dilution on the amount of coagulation required, the question of the effect of this dilution on the resultant rubber, is of much greater importance.

The addition of water to the cups, which is or has been a common practice in all estates, is not to be recommended, since it is impossible to supervise the amount added in each case, and the dilution, of the latex caused by such addition, is very variable, owing to the great variations in yield of latex by individual trees.

Latex can be collected, with very little natural coagulation in the cups, without the addition of water to the cups, provided glass or porcelain cups are used, and these are kept thoroughly clean.

Any dilution of the latex should be carried out in the factory, under supervision, so that the amount of water added is known.

It would appear that slow coagulation with a quantity of coagulant not much in excess of the minimum necessary to effect coagulation is preferable, and produces a rubber of better quality.

Rapid coagulation, which is caused also by using excessive quantities of coagulants, causes certain defects in 'sheet' rubber, such as air bubbles or 'coagulation marks,' which have been described before.

Other investigators have shown that the coagulation of colloids other than solutions of latex, depends on a time factor.

When strong coagulants or excessive quantities of coagulant are used, coagulation takes place immediately, whereas with the minimum amount of coagulant, complete coagulation takes place after a period of several hours.

If the rubber coagulum be removed from the serum as soon as coagulation is effected, it is found to be very soft and difficult to handle, whereas, if it is allowed to stand over-night, as is usually done, the clot contracts to form a firmer and more cohesive mass, and the rubber probably has better mechanical properties.

One disadvantage in allowing the rubber to stand for such a period before passing it through the rollers, is that darkening or oxidation takes place. This can be prevented to a great extent, however, by keeping the rubber from contact with air by complete immersion in the liquid serum. This is accomplished usually by covering the surface with a heavy board, so that the rubber is completely under water.

It is, therefore, recommended that the latex should be coagulated slowly by using only a slight excess beyond the minimum amount of acetic acid necessary, and by using a dilute (five per cent.) solution of the acid; the resulting rubber being left overnight and passed through the machines on the following day.

The action of sunlight was investigated on account of the frequency with which tacky samples of rubber were met with in some factories. It was invariably observed that these isolated cases of tackiness were found on samples exposed to the sun's rays near doors or windows.

Samples of rubber, both crepe and sheet, were consequently prepared and dried by exactly similar methods. In one case the sample was hung in the room and kept from exposure, and the second sample was suspended in a window exposed to the sun's rays. Several samples were treated similarly. In a very short time the samples exposed to the sun's rays became tacky, the tackiness increasing with the length of exposure. Samples of crepe appeared to become tacky more rapidly than sheet, owing probably to the greater amount of surface exposed. Another observation which proved that the tackiness was due to the exposure, was the fact that where rubber samples were protected by the wooden bars of the window in which they were suspended, the surface of these places was quite free from tackiness.

Whether this tackiness is due to light rays or to heat rays, has not yet been ascertained. The exact nature of the tackiness, has also not yet been ascertained.

It has, I think, already been sufficiently proved by the work of other investigators, that the ordinary darkening or rubber samples is due to an *oxidising enzyme, usually known as an 'oxidase,' which exists in the latex* derived from the trees.

In the case of Castilloa latex, the darkening of the latex itself is very marked and rapid, the surface becoming perfectly black when the latex is allowed to stand for only a few minutes exposed to the air.

The dark discolorations of the latex and rubber produced by these exoidases, are produced by coloured oxidation products of certain substances which exist in the latex together with the oxidase, so that the process is perhaps preferably described as an 'oxidation' process. The rapidity of the oxidation process is increased by certain salts, and inhibited by others, and the intensity of the darkening depends on the action of the oxidised substance, as will be shown by experiments to be described in this section.

One interesting feature in connection with this problem which it has been possible to investigate by experiment, is concerned with what is known as 'black latex.' Frequently on estates, certain trees yield a latex which, as it exudes from the tree, rapidly becomes darkened, the colour varying from pink to black.

This phenomenon is not constant for any individual trees, and a tree which yields such latex will, often subsequently yield a normal white latex without any apparent cause for such change.

The actual cause of the blackening, is due to the fact that the fluids which exude with the latex when the tissues are cut contain a larger proportion of the oxidisable substances which are acted upon by the oxidase in in the latex than is contained in normal latex.

This is a more probable explanation than the alternative one, namely, that this latex contains a larger proportion of the 'oxidase,' since a very small quantity of 'oxidase,' is capable of acting on a comparatively large amount of the oxidisable substances under proper conditions.

By avoiding contact with the air, a much lighter coloured rubber is produced, as the subsequent darkening which occurs after the rubber is washed and while drying is not marked, since the oxidase is soluble in water and removed to a great extent from the coagulum.

The darkening which does occur, is evidently due to the 'oxidase' which is precipitated together with the protein matter along with the rubber, and is not subsequently removed in the washing process.

This explains why it is possible to produce much paler 'crepe' rubber than 'sheet,' since the crepe is more thoroughly washed in the machines by being broken up in the rollers.

*Steaming.*—Another method of producing pale rubber—but this can be done with 'crepe' rubber—is to raise the temperature of the latex preferably by passing steam into the latex, or heating it in vessels surrounded by steam, to a temperature of about 80 deg. C. A short treatment by this process, destroys the 'oxidase,' and the rubber subsequently coagulated in the usual way, is very pale in colour.

A modification of this method, which is effective in the case of 'sheet' rubber, and which has been adopted on one or two estates, is to immerse the sheet (after washing) for a few minutes in nearly boiling water in a tank. The 'oxidase' remaining in the rubber is thus destroyed, and no subsequent darkening occurs on drying.

This method, however, is not to be recommended without further experiment, since it is very probable that the treatment of the freshly coagulated rubber, or the latex, with steam is detrimental to its mechanical and physical properties.

*Action of Sodium bisulphite.*—The value of sodium bisulphite as an inhibiting agent, is clearly proved by the experiments described in this section,

Other experiments were subsequently carried out, to ascertain the minimum quantity of this reagent necessary to produce an almost perfectly white rubber.

These experiments proved that 2 oz. per 10 gallons of latex, was sufficient for the purpose.

This gives 2 oz. of sodium bisulphite per 15 lb. of dry rubber, assuming a latex containing about 1·5 lb. of dry rubber per gallon (*i.e.*, a normal latex diluted with an equal quantity of water).

A beautiful pale crepe is obtained in this way in every case, and the small quantity of bisulphite, most of which is subsequently removed by the washing process, appears to have no deleterious effect on the rubber, even after the rubber has been kept for many months.

This treatment, is therefore, recommended for the preparation of pale 'crepes' and 'sheets' for which there will always be a market demand for certain purposes of the manufacturing industry.

The process is very economical, and amounts to less than one shilling per 300 lb. of dry rubber with sodium bisulphite at ½*d.* per lb. In the preparation of pale rubber, the abnormal 'black' latex described above should be collected separately.

One of the commonest defects in rubber samples, is that described under the fourth heading.

Samples are often found full of minute air bubbles, often appearing like white spots, and in some cases quite large and easily identified. The surface, too, is frequently found to be rough and pitted, where air bubbles have formed and have burst. These bubbles are frequently elongated, and appear to run in one direction. The actual cause of these bubbles, is the use of too concentrated a latex or too strong an acid, or an excessive quantity of acid, or perhaps the three causes combined.

In general, however, these defects are caused by the use of a too concentrated solution of acetic acid or an excess of the acid.

## Report of the Superintendent of the Rubber Sub-Station.

By W. A. Anderson.

### Tapping Ceara Rubber.

The Ceara tapping on the Nahiku plantations, has been directed chiefly towards the development of a system of tapping that would yield the largest amount of rubber per unit of labour, without injury to the tree, and curing the product in such a way, as to make it satisfactory to the manufacturers.

Many methods, which would give profitable results in most tropical countries with their cheap labour, were found to be impracticable here with labour, at approximately $1 per day. No satisfactory incision method for tapping the Ceará tree without removing the outer bark, has so far been found. At the same time, aside from the expense involved, the injury which results from the frequent stripping of the entire outer bark makes this undesirable.

In July, 1911, after a considerable amount of experimenting, tapping on a commercial scale, was started by, removing the bark to a height of about 19 inches, and pricking with a heel pricker, making pointlike incisions, run vertically, on four sides of the tree at each tapping. The latex was allowed to run to the ground, and left there until the following day, when it was coagulated. The rubber was then collected, in a very dirty state, washed with a single macerator, vaccum dried, hung in the air for one to two weeks, and then shipped. The average yield per day's labour, involved in preparing the trees, removing the bark, tapping, and collecting, on 5 year old trees, on 70 acres, in two months, was approximately 2 pounds of washed rubber. It was found, that after two weeks of tapping daily, the yield fell off to such an extent, as to indicate the suspension of tapping.

On trying to resume operations after a rest of two weeks, it was found that the flow of latex was hindered by the new outer bark, that was forming a scaly, powdery covering, which gradually became thicker and tougher, preventing the flow, so that the form of incision, could no longer be profitably made without stripping the bark again. Experiments in removing the bark on the 18 inches next higher up, showed that too little latex reached the ground, and that which remained on the tree could not be readily collected. Jobbing with a flat knife blade, making a horizontal incision on this newly stripped area, gave a better flow of latex, but the expense of collecting, proved impracticable both with and without a previous application of acetic acid.

These experiments, however, demonstrated two fundamental facts. First, that a knife jab made horizontally, gives better results than one made vertically; second, that the portion of the tree just above the ground, to a height of about 6 inches, yields rubber in much larger quantities than any

other portion. This area is never tapped when collecting cups are used, as the spout is necessarily inserted high enough to conduct the latex to the cup, set on the ground, and the tapped area is all above the spout, and, consequently, above the most prolific section of the tree.

The second of these facts, was utilized in the development of a system which has undoubtedly given better results in proportion to the labour involved than any other. By this method, the bark is removed to a height of about 6 inches, and cuts made with a very thin knife blade from the ground to the top of this stripped surface. The latex is allowed to flow to the ground and coagulate. The following day the rubber is collected and new cuts made at the same time.

The advantages are obvious. Only the richest portion of the tree is utilized, and at the same time, the portion where injuries heal most quickly. After the first cutting, the collecting and cutting are performed at the same time, thus saving one-half of the walking that would be necessary in passing from one tree to another if there were separate operations. The cutting knife is used to facilitate the removal of the rubber from the soil in collecting, so that there is no time lost in changing tools. The labourer carries his bucket in one hand, and his knife in the other, sets the bucket down, naturally nearest the hand that is freed, slips the knife under the lump of coagulated rubber, on the ground, lifts the rubber with the free hand, aided by the knife, deposits it in the bucket, and makes his new cut in the tree with the knife in the other hand, lifts the bucket with the free hand and passes on. It would seem, that the number of motions involved is reduced to a minimum. The largest amount of rubber collected in this way, by one man in one day of 10 hours' tapping and collecting, is 9 pounds of washed rubber, though, the average yield for 100 acres during six months' tapping, is somewhat less than 4 pounds.

The disadvantages, lie chiefly in the fact, that so small a portion of the tree is tapped. The yield per tree at each tapping is small, in some cases 1 pound of washed rubber to 400 trees. The number of tappings possible per year, as indicated by a six months' trial, is about 48, with two strippings per year. The removal of the bark appears to be less injurious on this area than higher up, and it is probable that the trees would stand this removal. Each stripping after the first is more difficult, as the cuts make the renewed bark very rough, and it breaks off in small patches instead of coming off as is the case with the first stripping. If the cut is made properly, it heals without a ridge, and more quickly here than elsewhere on the tree. Attempts to continue this method higher up on the tree, have not so far proven successful.

Having thus found approximately the maximum yield per day's work, attention was directed toward increasing the yield per tree, with a view to getting a proper adjustment between these two, which will be the point of diminishing returns. As satisfactory results were not obtained by continuing to remove the bark in horizontal strips, vertical strips were tried. First, a strip about one-third inch wide, was removed with a broad, U-shaped knife, gauged to remove only the outer bark, exposing the inner bark for incision. The incisions were made with a blade of the same width as the stripped surface, at regular intervals, along the length of the strip. In this way the yield per tree per tapping was increased, but too large a portion of the rubber remained on the tree as scrap, which could not profitably be collected. The application of a solution of acetic acid caused practically all the latex to coagulate on the tree, here it was collected to better advantage. To widen the stripped surface, a second cut was made 1 inch or more

from the first, and the bark between these two cuts was removed. This is done quickly and simply. The wider strap is treated with acetic acid, and incisions made at intervals of about 2 inches, with a blade 1 inch wide, so sharpened, as to touch the cambium at only two points instead of along the entire edge. The rubber is collected one hour after tapping.

The experiment is not yet completed, only one week's tapping having been done. It is found, however, that one man can make the incisions as fast as two men can collect, and three men in one day can incise, and collect from about 800 trees exclusive of stripping, securing about 1 pound of washed rubber to 70 trees. Four tappings, can be made on each strip before exposing a new surface. Including stripping and all labour, results for the week, were at the rate of 2¼ pounds per day's work.

For the purpose of comparing this method with the one previously described, which gave the maximum yield per day's work, we may call the former method A and this one B. Calling the average yield per day's work in A 4 pounds, and the average yield per tree one three-hundredths pound, we get 4 pounds from 1,200 trees in one day's work. In B we get 2 2/3 pounds from 186 trees in one day's work. It is obvious, that were the number of trees available unlimited, A would be the better method. Since on any plantation, however, the number of trees is necessarily limited, the total profit on labour from a given number of trees will determine the relative value of the two methods. From 50,000 trees A would give 167 pounds in 4,123 day's work. At $1 per day and $1 per pound (the approximate present values), profit on labour would be $125'33. B would give 683'4 pounds for 268'8 days' work, leaving a profit on labour of $414'60 from the same number of trees, from which it appears that B is the more profitable plantation method, so long as the value per pound of rubber remains greater than one-half the cost of a day's work.

This tapping was done in the last week of June. It is probable that better results can be obtained during the latter half of the year, as the trees are not in full leaf before the middle of July.

### Curing and Marketing Ceara Rubber.

The rubber obtained, was shipped direct to manufacturers in New York. The first shipment vacuum dried, was valued at 10 per cent. below the best Pará, and sold on that basis. Two later shipments, treated like the first in every way, but not vacuum dried, were valued over 25 per cent. below Plantation Pale Crepe. While the last shipment from which returns have been made, partly vacuum dried, was sold at 10 per cent. below Ceylon Fine Pale Crepe, and brought $1'15 per pound. The rubber is now all being vacuum dried and pressed, while still warm from the dryer into sheets, about 2 inches thick, 10 inches wide, and 3 feet long, weighing approximately 20 pounds each. The loss in washing and drying rubber thus prepared, has been found to be 2 1/5 per cent.

The conclusions from the work so far done are, that tapping method A is the cheapest and most desirable, where the trees to be tapped would furnish work for all the labour available, but method B gives greater profit from a given number of trees, and that either method can be carried on commercially, at a profit, under present conditions. The product, though very inattractive as it comes from the field, is capable of being turned into rubber of the first class, without too great expense.

Contemplated experiments on a commercial scale, to determine the effect of fertilizers on the yield of latex, have not been carried out, but it is hoped, that some work of this sort can be done in 1912.—*Annual Report of the Hawaii Agricultural Experiment Station for* 1912.

## SOILS: FERTILISERS.

Soil; Effect of partial sterilisation of—on the production of plant food. II. Limitation of bacterial numbers in normal soils and its consequences. E. J. Russell and H. B. Hutchinson. J. Agric. Sci., 1913, 5, 152-221.

The conclusions reached previously (this J., 1911, 471; 1912, 1045) have been confirmed and extended. Besides bacteria, the soil contains another group of organisms, provisionally identified as protozoa, which are detrimental to bacteria; they multiply more slowly and have a lower power of resistance to heat and antiseptics, hence the number of bacteria present in the soil is not a simple function of the temperature, moisture content and other conditions. Indeed, it often has no connection with these factors, but depends on the difference in activity of the bacteria and protozoa. In partially sterilized soil only the bacteria are left. In such soil bacterial multiplication is favoured by an increase of temperature or by variations in the moisture content in the normal manner. The protozoa are killed by any antiseptic vapour or by heating the soil at 55° —60 °C.; they suffer considerably at 40° C. and their activity is depressed on cooling the soil to low temperatures. Sterilization by heat effects a decomposition of the organic matter and simplifies the bacterial flora by exterminating some of the varieties. These effects become more pronounced as the temperature at which sterilisation is effected is raised. Maximum bacterial numbers are found in soils which have been heated to the minimum temperature necessary to kill the protozoa (about 60° C.); the number then corresponds with that present in soils sterilised by means of antiseptics. In soils heated to 100° C. although the number of bacteria is at a minimum the decomposition effect is at a maximum. The addition of unsterilised soil to partially treated soil leads to an increase in bacterial numbers and a still further production of ammonia and nitrate unless too large a quantity of these substances is already present. But the subsequent depression in bacterial numbers consequent on the development of the protozoa is generally without effect on the rate of decomposition, apparently because it does not set in until too late.—E. F. A.—*Journal of the Society of Chemical Industry.*

### Preparation of Bordeaux Mixture.

Experiments made by Mr. L. A Hawkins (U. S. Department of Agriculture Bulletin No. 265) indicate that Bordeaux Mixture may be made by adding *concentrated* calcium hydroxide to dilute copper sulphate, or *vice versa*, provided the mixture be sufficiently agitated. By this method the inconvenience of diluting the substances in separate and necessarily large vessels is avoided. To render it adhesive, Mr. Hawkins recommends 2 lb. of rosin fish-oil soap to 50 gallons of a 3-2-50 Bordeaux mixture. Next to rosin fish-oil soap, ground glue appears to be the most effective adhesive. Without a suitable adhesive the value of Bordeaux mixture is very seriously reduced.—*The Gardeners' Chronicle.*

### New Work on Rubber.

The Cambridge University Press will publish shortly a book on *Rubber and Rubber Planting*, by Dr. R. H. Lock. It deals with the history of the use and cultivation of rubber, its botanical sources, the botanical physiology of rubber and latex, the diseases, chemistry, and manufacture of rubber, and with rubber planting.—*The Gardeners' Chronicle.*